INSTRUCTION MANUAL

526

microwave amplifier

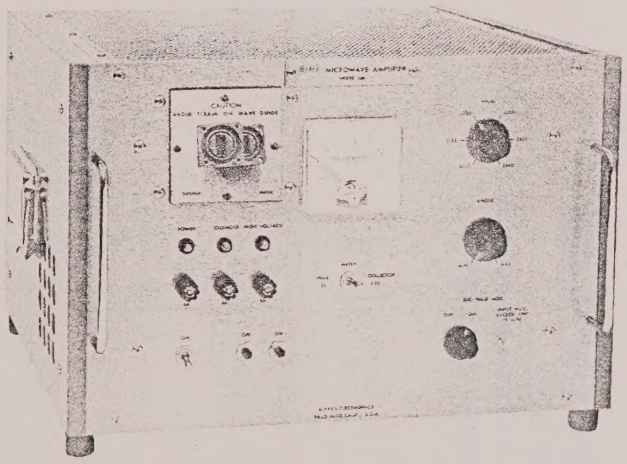
Model 528A Serial _____

ALFRED
SINGER
INSTRUMENTATION

INSTRUCTION MANUAL

microwave amplifier

Model 528A Serial _____



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THE SINGER COMPANY, LOS ANGELES OPERATION
5340 Alla Road, Los Angeles, California 90066

To the user of SINGER Instrumentation:

SINGER instruments are fabricated and tested under conditions of rigid manufacturing and quality control according to the best practice of the current state of the art. In addition, our Service and Applications Sections are available to you at any time.

The registration of your instruments and any comments will be most appreciated. The information concerning fields of application will aid us in providing you with pertinent literature from time to time.

REGISTRATION CARD

SINGER
INSTRUMENTATION

Name _____

Address _____

Models: _____ Serial No. _____

Date _____ CONDITION ON ARRIVAL _____

FIELDS OF APPLICATION _____

SEND APPLICATION DATA TO: _____

COMMENTS: _____

_____

Name & Title

WARRANTY

THE SINGER COMPANY, LOS ANGELES OPERATION, (SELLER) warrants each new instrument to be free from defects in material and workmanship, effective after delivery to the original purchaser as follows:

TCXO Oscillator	2 Years
Electrical and Electronic Measuring Instruments	1 Year

Repair or replacement (at our option) without charge (F.O B. factory) will be effected when our examination satisfactorily indicates that defects are due to workmanship or materials. Electron tubes, semiconductors, batteries, fuses, lamps, thermoelements, and RatioTran potentiometers are excluded from warranty coverage. Warranty returns must first be authorized by the factory.

If the instrument or any portion thereof, has been abused, misused, damaged by accident or negligence, or if any serial number or seal has been removed or altered, the warranty is void.

This warranty is in lieu of all other warranties, express or implied INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY, or fitness for a particular purpose. In no event shall the SELLER be liable for INCIDENTAL OR CONSEQUENTIAL damages. The SELLER neither assumes, nor authorizes any person to assume for it, any other liability in connection with sales of instruments manufactured by SELLER.

With respect to repairs, the foregoing warranty shall apply for a period of ninety days to the repaired portion.

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REPAIR AND MAINTENANCE

Instruments should be returned only on prior authorization from the Singer Representative or the factory. You will be advised of detailed shipping instructions at that time. Return the instrument to the factory Prepaid. Validity of warranty will be determined by the factory.

Chargeable repairs: If requested, an estimate of charges will be made prior to repairs. Please provide us with the following information in order to expedite the processing of your instrument:

1. Model or Type
2. Serial Number
3. Description of trouble(1)
4. Approximate date instrument was placed in operation.
5. Approximate number of hours in use.
6. Has maintenance action been previously requested.
7. Other comments.

(1) Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken and any other relevant data.

ADDENDUM SHEET

Model 526 only, for S/N 188 and up, and all replacement tubes

On the MEC tube #M2405F used in the Model 526, the anode voltage range specification has been changed to 2500 - 3400 V. Before operating the instrument, refer to the tube data sheet for the recommended anode voltage for the tube installed. If this voltage is 2700 volts or greater, follow the operating procedures given in this manual. If the recommended anode voltage is less than 2700 volts, note the following changes in the operating procedures:

Paragraph 3-2, step 6: The front panel ANODE control may have to be adjusted to a setting below the MAX position to give optimum performance. When measuring COLLECTOR X20 current as specified in this step of the procedure, DO NOT adjust the internal ANODE CALIB. control. Instead, turn the front panel ANODE control slowly CCW, away from the MAX position, until rated cathode current is obtained. Place a small piece of colored tape, or an ink mark, on the panel to identify this optimum setting of the ANODE control.

Paragraph 3-4, step 3: When raising the ANODE voltage slowly from the MIN setting, advance the ANODE control only as far as the "optimum setting" ink or tape mark established as above.

When a replacement M2405F tube is installed, carry out the above steps as applicable for the particular anode voltage recommended on the data sheet for the replacement tube.

12-27-65

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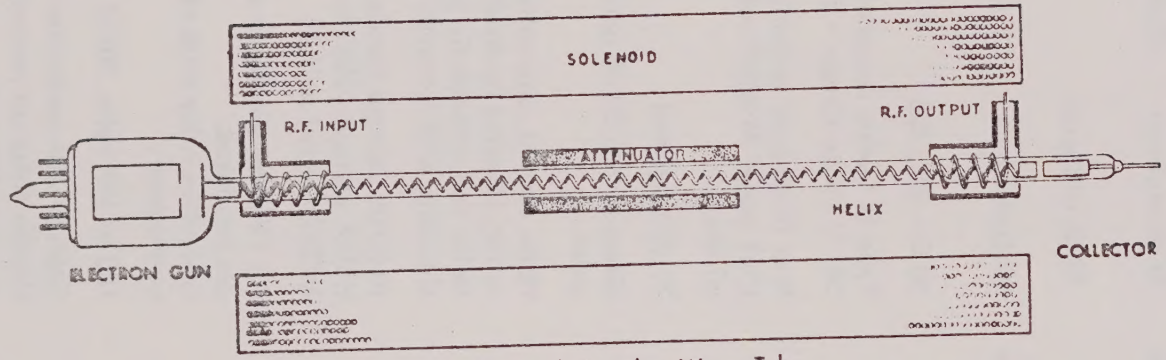
MICROWAVE AMPLIFIER
MODELS 526, 527, 527-S1, 528, 528A

SPECIFICATIONS	526	527	527-S1	528	528A
Frequency Range:	12.4 to 18 Gc	8 to 12.4 Gc	8 to 11 Gc	7 to 11 Gc	7 to 11 Gc
Power Output:	1 watt into 50 Ω load	2 watts into 50 Ω load	10 watts into 50 Ω load	5 watts into 50 Ω load	10 watts into 50 Ω load
Gain (@ rated power output)	30 db minimum	27 db minimum	30 db minimum	30 db minimum	25 db minimum
Spurious Modulation:		35 db minimum			
Gain (small signal @ 200 mw output):	30 db minimum	30 db minimum	33 db minimum	30 db minimum	30 db minimum
RF Impedance:		50 Ω - 527, 528			
RF Connectors:		Type N female receptale, 527, 528, 528A 541 U choke flange - 526			
Gain Adjustment:		0 to 10 db gain reduction at 200 mw by adjustment of front panel ANODE voltage control from maximum to minimum.			
Noise Figure:		35 db maximum			
Modulation:		Greater than 20 db gain variation by 300 volts external pulse.			
Metering:		Helix current, and collector current on 4" front panel meter, selected by front panel switch. Helix and cathode tip jacks available at rear for checking with external precision voltmeter.			
Front Panel Controls:		ANODE voltage (maximum to minimum setting). HELIX voltage (3000 to 3500 volts). METER current switch.			
Power Supply:		All TW tube electrode voltages, and solenoid current are regulated. Protective relay shuts off TW tube power upon helix overcurrent.			
Input Voltage:		105 to 125 volts, 50/60 cps, approximztely 1500 VA.			
Physical:		Cabinet with perforated metal dust cover. Handle sides are removable to permit mounting in standard 19" rack. Height: 12 1/4" Width: 19" Depth: 16" from panel, 17 1/2" overall.			
Finish:		Panel, grey. Sides, top and bottom, dark metallic grey.			
Weight:		130 pounds.			

6-29-67



Schematic View of Traveling-Wave Tube

FIGURE 1

SECTION 1 - GENERAL

1-1 DESCRIPTION

The ALFRED Models 526, 527 and 528 Microwave Amplifiers are stable, high gain, broadband power amplifiers of microwave signals operating in the frequency range of 7.0 to 18 Gc. They are compact, versatile instruments consisting of a traveling wave tube, its focusing solenoid, and a power supply for all required operating voltages. Electrical protection is provided to prevent damage to the power supply or the traveling wave tube from misadjustment or failures.

1. Power amplification of wide band signal generator outputs or complex modulated RF signals.

2. Amplification of RF pulses with rise times as short as a few millimicroseconds.

3. Isolation of a load from a microwave signal source.

4. Generation of extremely stable microwave oscillations either at fixed frequency or tunable over a wide range, using an external resonant feedback network.

On the front panel of the Models 526, 527 and 528, provisions are made for either Type N or wave guide fittings for the RF input and output. Also provided are controls for ANODE and HELIX voltages to optimize performance for specific applications. The front panel meter may be selected by a switch to monitor either helix or collector current.

The TW tube requires no RF adjustment, is encapsulated for protection, and is easily replaced. The TW tube RF connectors may be mounted on the front panel or on the rear deck, or the RF connectors may be reversed in the field.

The Models 526, 527 and 528 are built as convenient laboratory bench instruments. Removal of outside sheet metal sides permits mounting in a standard relay rack.

SECTION 2 - THEORY OF OPERATION

2-1 GENERAL DESCRIPTION OF TW TUBE

The traveling wave tube physical arrangement is indicated in Figure 1. The electron gun produces a beam of electrons which travels down the axis of the helical wire coil to the collector. The magnetic flux from the surrounding solenoid restricts the beam to travel axially along the tube just inside the helix.

RF signals at low impedance are connected to the helix at the electron-gun end and travel down the metallic path of the helix. The velocity of the electron beam is critically adjusted by the potential difference of the cathode and helix so that the beam velocity down the axis is just a little faster than the progressive RF signal on the helix. The field of the helix RF signal causes the electrons to bunch, so that at the collector end, their increased field returns to the helix an amplified signal which is conducted out to the load. Reflections down the helix are absorbed by the attenuator, consisting of a lossy helix externally placed and positioned between input and output. Due to the low impedance connections to the helix and the relatively long effective path provided by the TW tube, uniform amplification over a broad band of frequencies is achieved.

A more complete description and associated pertinent information are presented in the Engineering Notes, at the end of this manual.

2-2 TW TUBE PERFORMANCE CHARACTERISTICS

Gain and Power Output Figure 2 Model 526, Figure 3 Model 527, Figure 4 Model 528 show typical curves of small signal gain, gain at rated output, and maximum power output as a function of frequency. These curves are taken at rated helix voltage. The small signal gain is better than 30 db over the frequency range. Gain at rated output is greater than 30 db over the same frequency range. Anode attenuation is greater than 10 db by panel control and grid attenuation is greater than 30 db by an external 300 volt pulse. Grid modulating pulse voltage must exceed 270 volts. Pulses of lower voltage will cause improper tube operation.

2-3 RF LOAD

The TW tube may be operated at any collector current up to rated value into an RF load with any voltage standing wave ratio in the rated frequency range. Performance will be stable without spurious oscillations, but output power will be less into mismatched loads.

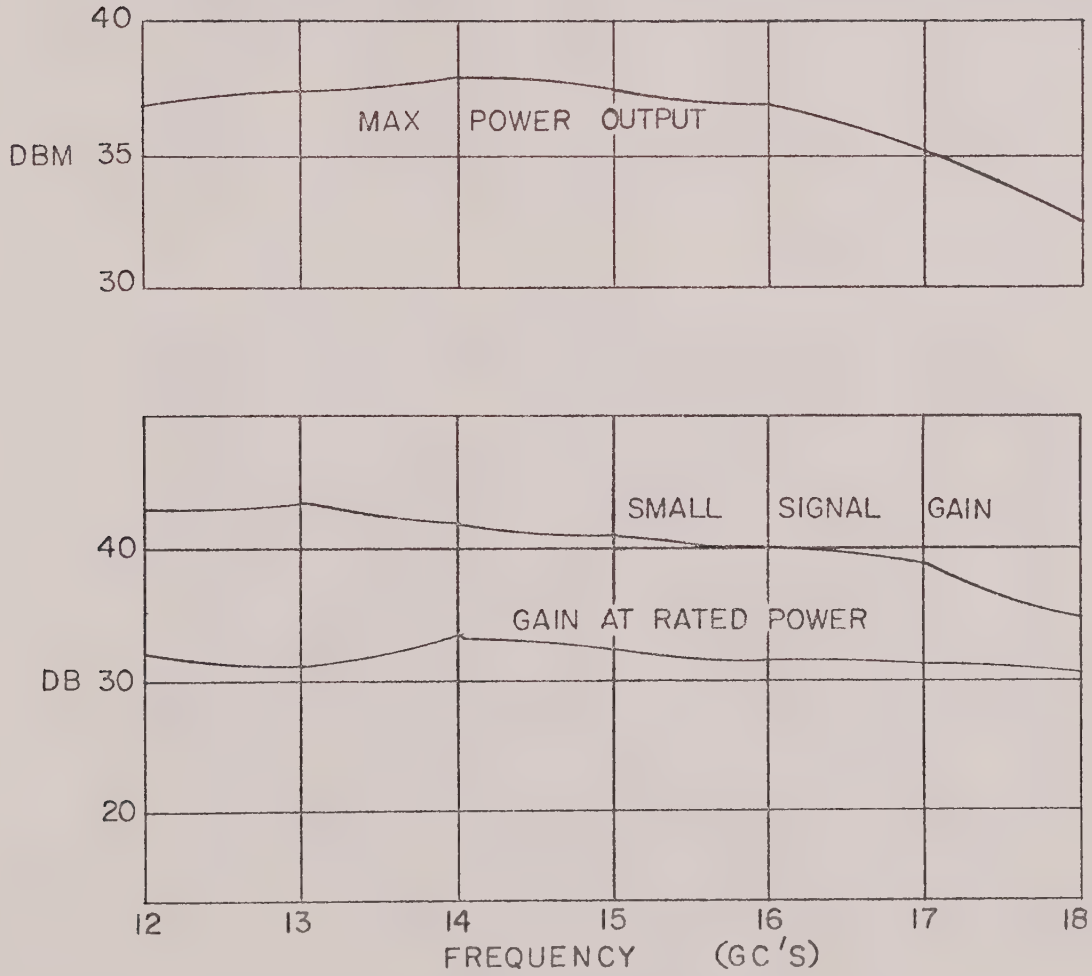
2-4 POWER SUPPLY

1. An electronically regulated solenoid current source providing 5 amperes at approximately 75 volts.

2. A transistor regulated AC heater supply for the TW tube providing 6.3 volts insulated for full cathode DC voltage.

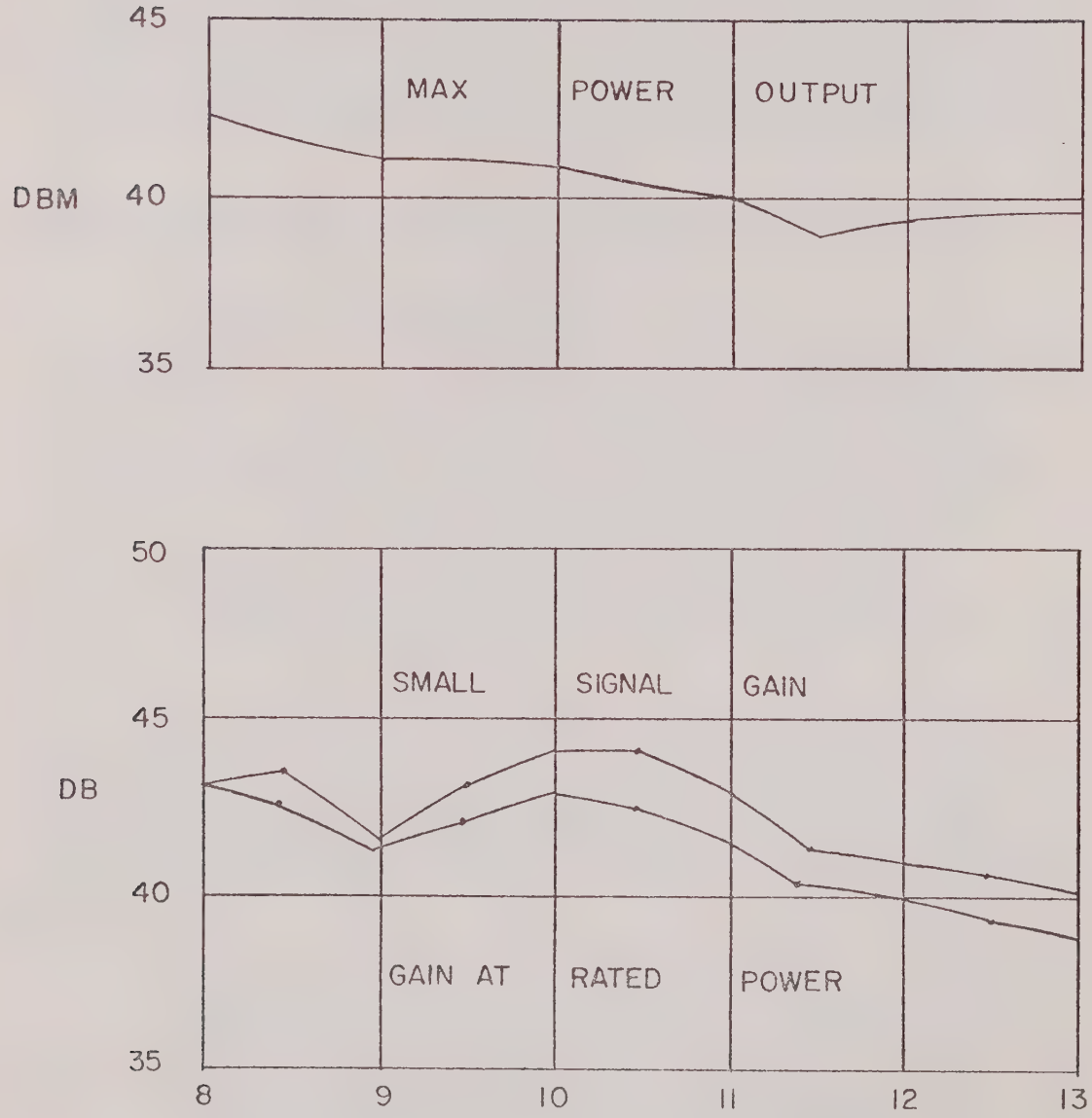
3. An electronically regulated Helix, Anode and Collector supply providing voltage from 2700 to 3500 volts with 300 mv peak to peak ripple or less.

   An overcurrent relay causes shutoff of all high voltage should helix current exceed 3 ma for any reason.



TYPICAL MODEL 526 POWER OUTPUT AND GAIN VS FREQUENCY

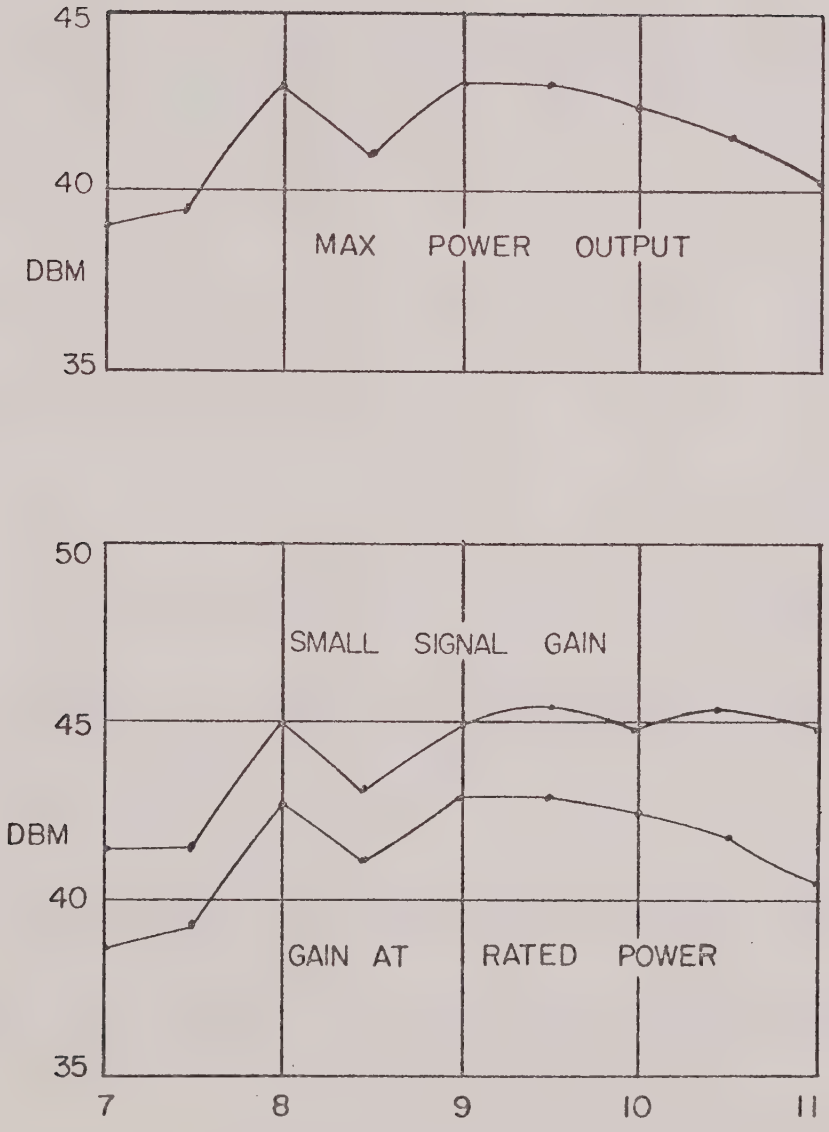
FIG. 2



TYPICAL MODEL 527 POWER OUTPUT

AND GAIN VS FREQUENCY

FIG. 3



TYPICAL MODEL 528 POWER OUTPUT
AND GAIN VS FREQUENCY

FIG. 4

2-5 FUNCTION OF CIRCUITRY

Function of circuitry--see schematic in back of manual.

2-6 POWER AND SWITCHING

All power to the instrument is fed through POWER switch SW1 and the normally closed thermal switch located in solenoid L2. The thermal switch is set to open at approximately 200° F. When the power switch SW1 is closed, transformers T1 and T3 are immediately energized through POWER fuse F2 to provide filament voltages to the -300 volt grid supply, the 56 volt screen supply, and the 200 volt supply required in the helix overcurrent relay RY2 circuit. Helix overcurrent relay RY2 picks up through tube V9. The high voltage circuit powered by transformer T2, through fuse F1 and contacts of relays RY1 and RY2 may be energized by depressing the "High Voltage On" switch SW3 to pick up relay RY1. Interlock contacts on RY1 maintain the circuit when SW3 is released. The H.V. supply may be de-energized by depressing HV OFF switch SW2 or should overcurrent relay RY2 drop out due to excessive helix current.

2-7 SOLENOID SUPPLY

Current regulated solenoid supply input power is applied to silicon rectifiers SR29 through SR32, through POWER switch SW1, SOLENOID fuse F3, and the normally closed Solenoid Thermal switch. Current from the rectifier is filtered by L1, C29 and C30. R100 and R101 serve as a current sensing resistance developing a voltage which is compared with the reference voltage from ZD2. Any error developed in the comparison circuit is amplified by Q3 and applied to the base of the current control transistor Q2. R95-98, are current shunts to minimize the loading on Q2. Diode SR34 and R94 comprise a circuit to protect ZD2 from overloads at turn on. R104 "SOLENOID I CALIB" is used to compensate for circuit element tolerances. The regulated current is then fed to focusing solenoid L2. A normally closed thermal switch mounted in L2 opens if its temperature exceeds 200° F to remove DC power from solenoid. Excessive temperature may damage both TW tube and solenoid and could result from blower failure or abnormal ambient. Blower power is obtained through fuse F3. R105 calibrates 1 amp/volt test points.

2-8 LINE REGULATED SUPPLIES 6.3V, 300 V, and 56 V

Regulation of these supplies is accomplished by regulating the input to the primary of transformer T3. Transistor Q1 is effectively in series with the input transformer T3. Rectifiers SR23 to 26 are connected in a bridge network to provide DC to the transistor for the positive and negative swings of the AC line. The drop across the transistor is automatically adjusted so the voltage to T3 will be maintained constant, independent of line voltage changes. The drop

across the transistor is varied by employing Zener diode ZD1 as a stable reference through which output voltage change controls net transistor base current. On one half cycle forward transistor emitter to base bias is developed through 5 K resistor R88 and the low forward diode resistance of the Zener. On the other half cycle the bias current is opposed by any output voltage in excess of the Zener breakdown voltage and is developed through the low forward diode resistance of SR22. Biasing is set so that variation of ± 10% maximum from nominal 115 volts rms input, will cause corrective changes in the drop across Q1 for less than ± 3% change in the output. Capacitor C24 serves to average the DC current pulses through the transistor and bypass any AC ripple. C23 operates in the same manner for the base bias current. Taps are provided on the transformer T3 primary to compensate for voltage tolerance of the Zener diode.

2-9 HIGH VOLTAGE SUPPLY

When transformer T2 is energized by depressing the H.V. ON switch approximately 4000 volts DC is supplied to the series control tubes, V1, V2, and V3 in parallel from the voltage doubling network of capacitors C4 and C5, rectifiers SR3 to 11, SR12 to 20 and winding 2-3 of T2.

The series regulating tubes V1, V2 and V3 in parallel are controlled by amplifier tubes V4 and V5 to provide an electronically regulated supply with a nominal value of 3500 volts. Reference voltage is developed across V6, V7, and V8 and is compared with the supply output voltage at the grids of differential amplifier V5. The amplified difference at the plates of V5 is applied to the cathode and grid of the left half of V4 by employing the right half of V4 as a cathode follower. The difference voltage is further amplified and appears at the plate of V4 left half as a single ended output to drive the grids of the series regulator tubes V1, V2 and V3. The series tubes will conduct more or less as required to reduce the difference in grid voltages to the differential amplifier V5 to zero and thereby maintain the supply output at -3500 volts.

The supply voltage is sampled by a resistor divider network consisting of HELIX CALIB. potentiometer R36 and precision resistors R37 through R44 to provide the input to grid (pin 2) of differential amplifier V5.

The positive side of the supply is connected to ground. The capsule and collector of the TW tube are connected to the ground side and the cathode to the -3500 volt side of the supply.

Helix voltage is obtained from the left half or pentode side of V9 acting as a cathode follower. The grid of V9 (pin 7) is connected to front panel control potentiometer marked HELIX and can be varied from approximately 0 to -500 volts with respect to ground or conversely from +3000 to +3500 volts with respect to TWT cathode. The plate voltage of V9 left half is supplied by T2 winding 4-5

through rectifier SR2B and filter capacitor C3. HELIX CALIB potentiometer R36 provides compensation for component tolerance variations so that accurate calibration of HELIX control potentiometer can be made.

Helix current through R67 varies the bias on tube V9 right half. When the helix current reaches maximum safe value, the bias is increased sufficiently to cut off the tube and drop out overcurrent relay RY2. Contacts of RY2 open the H.V. circuit to remove all high voltages from the TWT electrodes. Voltage for the plate of V9 right half and RY2 in series is provided by T1 winding 3-4 through resistor R1, rectifier SR1 and filter capacitor C1.

Filaments of series tubes V1, V2 and V3 are connected in series so that failure of one will turn off all and prevent overloading of operative tubes. Heaters of amplifier tubes V4, V5 and overcurrent relay tube V9 are also connected in series so that open circuit on any heater will turn all off, dropping out relay RY2 and removing high voltage.

Anode voltage is obtained from the wiper of front panel potentiometer marked ANODE through the resistor divider string of R72 through R83. ANODE CALIB potentiometer R72 provides compensation for component tolerance variations for calibrating the ANODE potentiometer R73. ANODE potentiometer R73 permits setting of TWT anode voltage to desired operating value.

Helix, Anode and Cathode tip jack connections are provided on the rear of the instrument for external voltage measurements.

Switch SW5 selects either Collector or Helix current to be measured with meter M1. Shunts R84 and R85 provide scale multiplication. During the switching action of SW5 only the meter connections are broken, the shunts remain in their respective circuits so that neither the collector or helix circuits are broken during switching.

2-10 EXTERNAL PULSE MOD AND GRID CALIB

Transformer T3 winding 1-3, rectifiers SR27 and SR28, capacitors C25 and C26 form a voltage doubling network to provide -300 volts relative to the TWT cathode line. GRID CALIB. potentiometer R89 in series with R90 across the supply furnish a variable grid voltage of 0 to approximately -70 volts which is connected to the grid through EXT PULSE MOD switch SW4A and R91 when SW4A is in OFF position.

When the EXT PULSE MOD switch SW4 is in the ON position, the -300 volts is connected to the TWT grid through R91 to bias the TW tube to cutoff. An external positive pulse may now be applied to the TWT grid through EXT PULSE MOD connector S1, SW4B and capacitor C28 to grid modulate the tube. The amplitude of the pulse must exceed approximately 270 volts to turn the tube on.

The TW tube in this amplifier is of the convergent flow type and GRID voltage affects focus. The transition from -300 volts to operating grid value must be made very rapidly, otherwise high helix current and hence trip out would occur. Diode V10 serves as a clamp during pulse operation to limit the grid voltage from exceeding the normal CW value as set by the GRID CALIB potentiometer R89. In the OFF position of SW4B the junction of C28 and R92 is connected to +280 volts to decrease the voltage change across C28 when EXT PULSE MOD switch is changed from ON to OFF position.

SECTION 3 - INSTALLATION AND OPERATION

3-1 INSTALLATION

Upon receipt carefully unpack and inspect the instrument for damage received from transit. Should any damage be found, follow procedure outlined on "Shipment Damage Claim" page at the end of this manual.

This instrument is designed for either bench or rack operation in normal ambient temperatures. Air flow through the unit and from the solenoid exhaust should be completely unrestricted. Operation in the presence of very strong magnetic fields should be avoided unless external magnetic shielding is provided. Primary power requirements are 105 to 125 volts, 50 to 60 cps, approximately 1200 VA. If operation at other voltages or frequencies is required, consult manufacturer.

The 526, 527, 528 instruments are supplied with grey sheet metal sides containing handles. If the instruments are to be rack mounted, the screws on each handle side except those holding handle, should be taken out and the sides removed. Unit is now ready for inserting into rack. Supports should be provided in the rack to carry the weight of the unit upon its insertion or removal.

3-2 INITIAL OPERATION

1. Before turning on power, set panel controls:

   ANODE to MIN
   HELIX to 3000
   METER switch to HELIX
   EXT PULSE MOD to OFF

2. Turn on power and allow instrument to warm up at least 5 minutes.

3. Depress HIGH VOLTAGE ON switch.

4. Slowly advance HELIX control to operating value specified on TW tube data sheet. Note that as HELIX is advanced, helix current should be well below 3 ma. If helix current is near or exceeds 3 ma the TWT probably requires realignment in its solenoid. See Paragraph 4-6 for alignment procedure.

5. Slowly advance ANODE control to MAX. Before MAX position is reached helix current will peak and then drop down to an operating value well below 3 ma. Should helix current remain near or exceed 3 ma, the TWT will require realignment as noted above.

6. When ANODE has been advanced to MAX and HELIX to value specified on tube data sheet with helix current at or below its maximum value, change METER switch to COLLECTOR X20. Current should be at or slightly greater than the operating value of cathode current given on the TW tube data sheet enclosed at the rear of this manual. If current reading is too low, ANODE CALIB. control near top right side of chassis requires resetting. Remove top dust cover for access to control. Adjust until rated cathode current given on tube data sheet is obtained, alternately checking helix current to assure it remains below maximum value. If unable to obtain rated value with helix current below 3 ma, the TWT requires realignment.

7. Apply RF. Input power up to 1 watt will not cause damage. However, only the normally required level of a few milliwatts or less should be used. If RF output can be observed, adjust, if necessary, HELIX voltage slightly for optimum output. See also Section 3-3. If RF output cannot be measured, connect a 1/2% or better accuracy voltmeter to read HELIX VOLTAGE between HELIX and CATHODE tip jacks at rear of instrument and set HELIX control to give a measured voltage exactly that specified on TW tube data sheet.

8. If significant line frequency is observed, very slight repositioning of the TW tube in the solenoid may be required to null out stray magnetic fields from the power transformers in the instrument. Both helix current and AC field nulls occur at essentially the same mechanical positions, so slight turning of the adjusting screws, usually will give best modulation minimum without appreciably affecting helix current. Be sure that adjusting screws are locked at the best position and adjusting hole covers on solenoid are in proper place.

9. Resetting of ANODE control and a recheck of helix voltage, as described in 4 and 5 of above, may be necessary after one hour to correct for slight warmup drift. Position of ANODE control on panel should be noted so that it can easily be reset, should it accidentally be changed.

10. METER switch should be left in COLLECTOR X20 position during normal operation. An occasional check of helix current is recommended.

3-3 SYNCHRONISM

When the velocity of the electron stream and the progressive velocity of the RF signal are essentially the same, they are said to be in SYNCHRONISM. When

operation at a single frequency is contemplated, helix voltage can be adjusted to synchronous value, to give maximum gain and output at that frequency. When operation over a wide band of frequencies is contemplated, the helix voltage adjustment should be made to the factory determined value. At this setting synchronism usually occurs at some frequency usually near the high end of the band. Even though other frequencies are off synchronism, rated broadband response results.

3-4 REPEAT OPERATION

1. Before turning on power, turn ANODE control to MIN.

2. Turn on power and allow 5 minutes warmup.

3. Depress HIGH VOLTAGE ON switch and raise ANODE to MAX., noting that helix current does not exceed 3 ma and should drop well below this at MAX position. If too high, turn ANODE to MIN and follow procedure outlined in INITIAL OPERATION Paragraph 3-2 above, to optimize performance.

3-5 OPERATION AS AN AMPLIFIER

Amplification is linear for RF output up to 6 db below saturation. Further drive beyond this level causes the output to flatten and then decrease. Operation in the region of saturated output is non-linear, causing appreciable distortion and harmonic content in the output signal.

3-6 OPERATION AS A BUFFER

The Models 526, 527, 528 can serve very effectively to isolate a microwave signal source from a load. Reflections from mismatches, load variations, and the effects of modulation will not appreciably affect the impedance of the input terminals of the amplifier. The attenuator on the TW tube helix provides approximately 55 db attenuation between input and output, so load changes will be isolated from the source by this 55 db attenuation less the gain of the amplifier. The extreme case of a short or open circuit would be to change the VSWR of the amplifier input by about 7%.

3-7 OPERATION AS AN OSCILLATOR

The use of an external feedback circuit involving a passive resonator such as a cavity, will permit use of the TW tube amplifier as an extremely stable fixed frequency or wide range oscillator. Oscillation results when total loop phase shift is in the vicinity of n x 360° producing positive feedback. This is accomplished by careful adjustment of helix voltage. Since helix voltage accelerates the electrons in the beam, it determines their velocity through the helix. Transit time and phase between output and input of the TW tube therefore, varies with

helix voltage. When a continually adjustable resonator is employed, it is necessary to optimize phase with the HELIX control progressively across the band. Otherwise, a series of oscillation modes will occur as phase of the TW tube amplifier rotates. A directional coupler or non-dissipative attenuator should be employed in the feedback line to minimize amount of output power fed to the input. This reduces harmonics and makes available almost all output power to drive a load.

SECTION 4 - MAINTENANCE

4-1 GENERAL

CAUTION: Extremely dangerous high voltages exist in this instrument. Observe the utmost care when checking or making repairs.

Routine maintenance should consist of the following:

1. Check blower operation every three months or after 1000 hours use, and oil bearings with a few drops of light machine oil in the oil tubes provided. Regulat attention to the blower is essential since its failure could result in damage to the TW tube from overheating.

2. Test at regular intervals the power supply tubes to detect marginal performance. Any voltage regulator tubes removed for test should be returned to their original sockets. INTERCHANGING OR REPLACING VOLTAGE REGULATOR TUBES WILL NECESSITATE RECALIBRATION OF HELIX SUPPLY VOLTAGE.

3. As TW tube ages, preset ANODE CALIB control may require readjustment to maintain rated collector current when panel ANODE control is at maximum.

4-2 CALIBRATION OF HELIX SUPPLY VOLTAGE

Calibration of helix supply voltage is accomplished by connecting an ungrounded voltmeter having 1/2% accuracy or better to the Helix Voltage test points on the rear of the unit. Unlock the HELIX CALIB control, located near the right top side of chassis. With TWT disconnected, move panel HELIX control over entire range and note readings. Adjust HELIX CALIB control so that voltage indications are within ± 2% for any setting. Lock HELIX CALIB control.

4-3 TROUBLE SHOOTING

Should a failure occur, follow a logical procedure to locate the cause. Refer, if necessary to the THEORY OF OPERATION section and the schematic diagram included in this manual. Blown fuses should be replaced with 250 volts, type 3AG.

Power supply tubes can be observed to determine if heaters are operating and voltage regulator tubes lit, by removing screws, holding top dust cover and sliding it rearward. Operating voltages for the traveling wave tube may be measured as described below. Correct voltages are indicated on the circuit diagram.

Helix: Helix and Anode voltages relative to cathode are available at tip jacks on rear cover. CAUTION: Use high resistance, ungrounded DC voltmeter, HIGH VOLTAGES EXIST ON TERMINALS.

The Grid and Heater voltages may most easily be checked by removing power from the instrument and disconnecting the TWT connectors from sockets S2 and S5. The electrode voltages are then accessible (power on) at the connector pins. Use a high resistance DC voltmeter insulated from ground in making measurements. Refer to schematic diagram and check out sheet for correct values and polarity.

If tubes have been tested and found to be normal and supply voltages are incorrect, it is recommended that power be disconnected and faulty components located by a systematic resistance check.

For access to chassis components remove right handle side and cover side.

For access to solenoid chassis remove left handle side and cover plate.

For access to solenoid supply transistor located in air stream of blower, proceed as follows:

1. Remove screen, bottom plate, L.H. handle side and cover side.
2. Remove two #6-32 screws which are on L.H. transistor bracket (as viewed from front of unit) accessible through clearance holes in solenoid chassis.
3. Remove two #6-32 screws on R.H. bracket accessible from inside unit near blower.
4. Blower may now be removed.
5. Pull bracket holding transistor out from blower until transistor is accessible.
6. Use care in mounting; use heat sinks when soldering connections to transistor.
7. Use reverse procedure for reassembly.

For access to panel components, remove top dust cover and/or bottom plate. For access to panel indicators and fuses, blower must be removed. (See above.)

Components mounted in solenoid sub-chassis are accessible by removing three screws holding sub-chassis to solenoid chassis.

CAUTION: Use heat sinks during soldering operations on transistors and diodes.

4-4 BLOWER REPLACEMENT

Remove bottom plate and top dust screen, remove four mounting screws (6-32) as described in Paragraph 4-3.

Disconnect two transistor mounting brackets from blower housing.

Remove blower leads from barrier strip on solenoid chassis.

Blower may now be removed. In reassembly follow reverse procedure.

4-5 TRAVELING WAVE TUBE REPLACEMENT

1. Remove top dust screen.
2. Remove RF cover plate from front panel.
3. Disconnect TWT lead connectors.
4. Loosen TWT adjusting hole cover for access to TWT locking screws.
5. Loosen TWT locking screws.
   NOTE: There are three locking screws at each end. Two are accessible from the top with the instrument top cover removed, and one is accessible from the bottom when the instrument bottom cover is removed.
6. Tube is now free for removal through front panel.
7. Center new tube in solenoid and place TWT clamp to scribe line on shell. Observe due caution to prevent damaging the tube.
8. Replace cover plate and make RF connections. Do not connect TWT power plug - see alignment procedure.
9. Use care in making waveguide connections to avoid undue strain on the RF connectors. The tube is held in place in the instrument by the TWT adjusting screws. Excessive pressure on the connectors could result in misalignment or damage to the tube.

4-6 TRAVELING WAVE TUBE ALIGNMENT PROCEDURE

Realignment of the TWT within the solenoid is necessary after TW tube replacement or where de-focus has occurred due to repair, shock or other reasons.

1. With the power off, disconnect TWT power plug.

2. Set panel controls as follows:

   ANODE to MAX
   EXT PULSE MOD to OFF
   METER switch to HELIX

3. Turn on power and allow amplifier to warmup for five minutes.

4. With at least a 20,000 Ω/V voltmeter, set helix, anode and grid voltages to values shown on tube data sheet. Use ANODE CALIB and GRID CALIB potentiometers (located on right hand chassis upper front). CAUTION: HIGH VOLTAGE, USE EXTREME CARE IN MAKING THESE MEASUREMENTS. Use HELIX control on panel in setting helix voltage.

5. Turn off power and connect TWT power plugs.

6. Set ANODE to MIN

7. Turn on power.

8. Alignment is accomplished by removing top perforated dust cover and adjusting the TW tube positioning screws at each end of the solenoid. Orient TW tube to obtain the lowest HELIX current, all the while advancing the ANODE control. ADJUST CAREFULLY TO AVOID HIGH HELIX CURRENT DURING ADJUSTMENT. Should helix current accidentally exceed 3 ma, overcurrent relay will shut off power supply. Operation can be restored by turning ANODE control counterclockwise and then again depressing HIGH VOLTAGE switch to ON. If helix overcurrent trip occurs again, turn EXT PULSE MOD switch to ON. This puts -300 volts on grid so that a rough alignment can be made without trip out. After obtaining control of helix current in this position, return EXT PULSE MOD to OFF for greater sensitivity before continuing with the alignment.

   Positioning of the TW tube is most easily accomplished with two screwdrivers in each end. Starting with the tube approximately in the center of the solenoid, slowly wobble the tube with the alignment screws to minimize helix current. Adjust alternately with the two top screws at each end. Loosen the bottom locking screws as necessary to permit free adjustment of the tube within the solenoid to achieve the optimum position. After a minimum setting is reached, one screw should be turned, usually causing helix current to increase, and then the null relocated by turning a different screw. Often the new null is lower than the original. Reverse direction of turning if the new null is higher. Slight rotation of the TW tube may also result in a lower minimum. With a little care, helix current usually can be reduced to a safe value. Locking screws on bottom should be tightened enough to prevent the tube

shifting during normal handling of the instrument. Be sure to replace adjust hole cover to prevent air loss and overheating.

Maximum helix current (under drive) up to about 3 ma is safe. However, the lower the current, the less chance that gas will be driven from the helix due to high temperature operation. Gas would soon damage the cathode emission and render the TW tube inoperative. Lower current also reduces modulation of the RF output by beam noise and stray magnetic fields.

4-7 REVERSAL OF RF INPUT AND OUTPUT

The RF input and output may be reversed in the field.

To change from RF front to RF rear order parts:

1.	903433A	Front Blank Cover Plate
2.	903457A	Rear RF Plug Mounting Plate or
	903458A	Rear Waveguide Cover Plate

To change from RF rear to RF front, order parts:

1.	904047A	Rear Exhaust Screen
2.	903434A	Front RF Plug Mounting Plate or
	903431A	Front Waveguide Cover Plate

To change proceed as follows:

1. Remove TW tube as described in Paragraph 4-5 above.
2. Remove blower as described in Paragraph 4-3 above.
3. Remove transformer and capacitor sub-assembly mounted with 6-32 screws.
4. Remove two air brackets and move to opposite position. (Front to rear of unit or vice versa.)
5. Remove solenoid spacer plate and move to opposite position.
6. Remount transformer and capacitor sub-assembly in opposite position.

4-8 TRAVELING WAVE TUBE WARRANTY

All workmanship and materials, except the traveling wave tube, are guaranteed for one year. Details concerning warranty adjustment are presented on "Shipment Damage Claim" page at the end of this manual. Details concerning the TWT warranty are presented on the "Tube Warranty and Replacement Procedure."

CIRCUIT REFERENCE	ALFRED PART NO.	DESCRIPTION	TOTAL QTY.	VENDOR	VENDOR PART NO.
C1	13-11	Capacitor, fixed, elect., 20 µf, 500 v, twist lok	1	Mallory	F.P. 173
C2 and C3	13-3	Capacitor, fixed, elect., 50 µf, 150 v, axial lead	4	Sprague	TVA-1414
C4 and C5	15-12	Capacitor, fixed, oil, metal case, 4 µf, 2.5 KV, 10%	2	General Electric	23F1105G103
C6		Same as C2			
C7	12-2	Capacitor, fixed, ceramic, 0.001 µf, 600 v, 10%	1	Erie	811-102
C8 and C9	14-10	Capacitor, fixed, mylar, 0.0047 µf, 6 KV, 10%	4	C.D.	PKM60-D5
C10	13-4	Capacitor, fixed, elect., 150 µf, 150 v, axial lead	1	Sprague	D26978
C11	14-27	Capacitor, fixed, paper, 1 µf, 600 v, 10%	1	Sprague	6TM-M1
C12	12-3	Capacitor, fixed, ceramic, 0.01 µf, 500 v, 20%	3	CRL	DA-049-211CB
C13	11-5	Capacitor, fixed, mica, 100 µµf, 500 v, 5%	1	Sangamo	DR1310
C14 and C15	14-6	Capacitor, fixed, paper, 0.1 µf, 600 v, 10%	2	Sprague	160P10496
C16	13-2	Capacitor, fixed, elect., 20 µf, 150 v, axial lead	2	Sprague	TVA1410
C17	16-1	Capacitor, fixed, 0.1 µf, 5 KV, glass-encased	2	Plastic Cap	OF-50-104
C18 & C19		Same as C8			
C20 & C21		Same as C12			
C22		Not used			
C23 & C24	13-23	Capacitor, fixed, elect., 100 µf, 100µf/200 v, twist lok	2	Sprague	TVL 2464
C25 & C26	13-21	Capacitor, fixed, elect., 20 µf, 250 v, axial lead	2	Sprague	TVA 1508
C27		Same as C2			
C28		Same as C17			
C29 & C30	13-6	Capacitor, fixed, elect., 1000 µf, 150 v, tub-cased	2	Mallory	HC 15010A
C31		Same as C16			

CIRCUIT REFERENCE	ALFRED PART NO.	DESCRIPTION	TOTAL QTY.	VENDOR	VENDOR PART NO.
F1	121-5	Fuse, 5A, 250 v, type 3AG	1	Littelfuse	312005
F2	121-6	Fuse, 6A, 250 v, type 3AG	1	Littelfuse	312006
F3	121-8	Fuse, 8A, 250 v, type 3AG	1	Littelfuse	312008
I1 thru I3	126-5	Lamp, neon, 115 VAC operation, pilot lamp, clear lens, 3/8" mounting hole	3	Tec-Lite	MDL1S2-F7 NE2U
L1	93-3	Choke, 0.1 hy, 5A-DC, 0.8 Ω, 5 KV Insulation	1	Paeco	1114
L2	B100AE	Solenoid (TWT focus)	1	Alfred	B100AE
M1	86-38	Meter, 3 ma scale dc, 3-1/2", clear plastic case, 2%	1	Hoyt	653
Q1 and Q2	81-9	Transistor, 2N173, PNP, Vce 45 v, 50 watt, Ge, Audio, Beta = 20	2	Motorola	2N173
Q3	81-21	Transistor, 2N1038-1, PNP, 20 watt, Ge, Vce 30 v, Beta = 20	1	Texas Inst.	2N1038-1

CIRCUIT REFERENCE	ALFRED PART NO.	DESCRIPTION	TOTAL QTY.	VENDOR	VENDOR PART NO.
R1	42-47 Ω	Resistor, fixed, comp., 47 Ω, 1 w, 10%	1	Allen Bradley	GB 4701
R2 thru R23		Not used			
R24	42-100 Ω	Resistor, fixed, comp., 100 Ω, 1 w, 10%	1	Allen Bradley	GB 1011
R25 thru R30	41-1 K	Resistor, fixed, comp., 1 K, 1/2 w, 10%	6	Allen Bradley	EB 1021
R31 and R32		Not used			
R33	41-100 K	Resistor, fixed, comp., 100 K, 1/2 w, 10%	1	Allen Bradley	EB 1041
R34 and R35	42-470 K	Resistor, fixed, comp., 470 K, 1 w, 10%	2	Allen Bradley	GB 4741
R36	71-4	Potentiometer, 100 K, 1/2 w, 20% comp. 1/2" long shaft w/S.D. slot, locking	1	Clarostat	37 Series-100 K
R37 and R38	53-500 K	Resistor, fixed, dep. carbon, 500 K, 1 w, 1%	8	Electra	DC-1-500K
R39 thru R44	53-1 M	Resistor, fixed, dep. carbon, 1 M, 1 w, 1%	6	Electra	DC-1-1M
R47 and R48	42-1.5 M	Resistor, fixed, comp., 1.5 M, 1 w, 10%	2	Allen Bradley	GB 1551
R49	42-1 M	Resistor, fixed, comp., 1 M, 1 w, 10%	3	Allen Bradley	GB 1051
R50 and R51		Not used			
R52	42-150 K	Resistor, fixed, comp., 150 K, 1 w, 10%	2	Allen Bradley	GB 1541
R53 thru R59	43-120 K	Resistor, fixed, comp., 120 K, 2 w, 10%	7	Allen Bradley	HB 1241
R60	43-150 K	Resistor, fixed, comp., 150 K, 2 w, 10%	1	Allen Bradley	HB 1541
R61 and R62		Not used			
R63	71-7	Potentiometer, 1 M, 1/2 w, 10% comp., 3/8" long shaft	1	Clarostat	37 Series-1 M

CIRCUIT REFERENCE	ALFRED PART NO.	DESCRIPTION	TOTAL QTY.	VENDOR	VENDOR PART NO.
R64 thru R66	43-1.2 M	Resistor, fixed, comp., 1.2 M, 2 w, 10%	3	Allen Bradley	HB 1251
R67	53-12 K	Resistor, fixed, dep. carbon, 12 K, 1 w, 1%	1	Electra	DC-1-12K
R68	53-25 K	Resistor, fixed, dep. carbon, 25 K, 1 w, 1%	1	Electra	DC-1-25 K
R69	53-2.2 K	Resistor, fixed, dep. carbon, 2.2 K, 1 w, 1%	1	Electra	DC-1-2.2K
R70		Not used			
R71	53-1.8 M	Resistor, fixed, dep. carbon, 1.8 M, 1 w, 1%	1	Electra	DC-1-1.8 M
R72	71-25	Potentiometer, 1M, 2 w, 10%, comp., 1/8" long shaft w/S.D. slot, locking	1	Ohmite	CLU 1052
R73 (A & B)	71-3	Potentiometer, 500 K/500 K dual 1/2 w, 10% comp., 1-5/8" long shaft	1	Ohmite	CCU 5041
R74 thru R79		Same as R37			
R80 thru R83	53-400 K	Resistor, fixed, dep. carbon, 400 K, 1 w, 1%	4	Electra	DC-1-400 K
R84	55-19	Resistor, fixed, wire wound, 1.69 Ω, 1 w, 1%	1	K & F	M-2-1.69 Ω
R85	55-20	Resistor, fixed, wire wound, 49.9 Ω, 1 w, 1%	1	K & F	M-2-49.9 Ω
R86 and R87		Not used			
R88	61-2	Resistor, fixed, wire wound, 5 K, 5 w, 5%	1	Lectrohm	C5-5K-T5
R89	71-3	Potentiometer, 50 K, comp., 1/2 w, 20%, 1/8" long shaft w/S.D. slot, locking	1	Clarostat	37 Series-50 K
R90		Same as R52			
R91	42-120 K	Resistor, fixed, comp., 120 K, 1 w, 10%	1	Allen Bradley	GB 1241
R92 and R93		Same as R49			
R94	43-10 Ω	Resistor, fixed, comp., 10 Ω, 2 w, 10%	1	Allen Bradley	HB 1001
R95 thru R98	64-9	Resistor, fixed, wire wound, 5 Ω, 50 w, 5%	4	Lectrohm	E50-5-T5
R99	42-4.7 K	Resistor, fixed, comp., 4.7 K, 1 w, 10%	1	Allen Bradley	GB 4721
R100	64-12	Resistor, fixed, wire wound, 1 Ω, 50 w, 5%	1	Lectrohm	E50-1-T5

CIRCUIT REFERENCE	ALFRED PART NO.	DESCRIPTION	TOTAL QTY.	VENDOR	VENDOR PART NO.
R101	64-25	Resistor, fixed, wire wound, 0.4 Ω, 50 w, 3%	1	Lectrohm	XE50-0.4-T3
R102 and R103	64-10	Resistor, fixed, wire wound, 500 Ω, 50 w, 5%	2	Lectrohm	E50-500-T5
R104	71-40	Potentiometer, 50 Ω, 2 w, 10%, comp., 1/8" long shaft w/S.D. slot	1	Ohmite	CLU 5001
R105	71-45	Potentiometer, 100 Ω, 2 w, 10%, comp., 1/8" long shaft w/ S.D. slot, locking	1	Ohmite	CLU 1011
R106	53-500	Resistor, fixed, dep. carbon, 500 Ω, 1 w, 1%	1	Electra	DC-1-500 Ω
R107 thru R109		Not used			
R110	41-47 Ω	Resistor, fixed, comp., 47 Ω, 1/2 w, 10%	1	Allen Bradley	EB 4701
R111 and R112	61-22	Resistor, fixed, wire wound, 8 M, 4 w, 20%, 5 KV	2	IRC	MVG-13
RY2	106-4	Relay, DC, 110 v coil, DPDT, 5A, 10 K Ω	1	Potter & Brumfield	KA1466 or KA11DY
RY7	106-7	Relay, AC, 115 v coil, DPDT, 15 A, 445 Ω	1	Potter & Brumfield	KA11AG
S-1	131-UG 1094	Connector, UG1094/U			

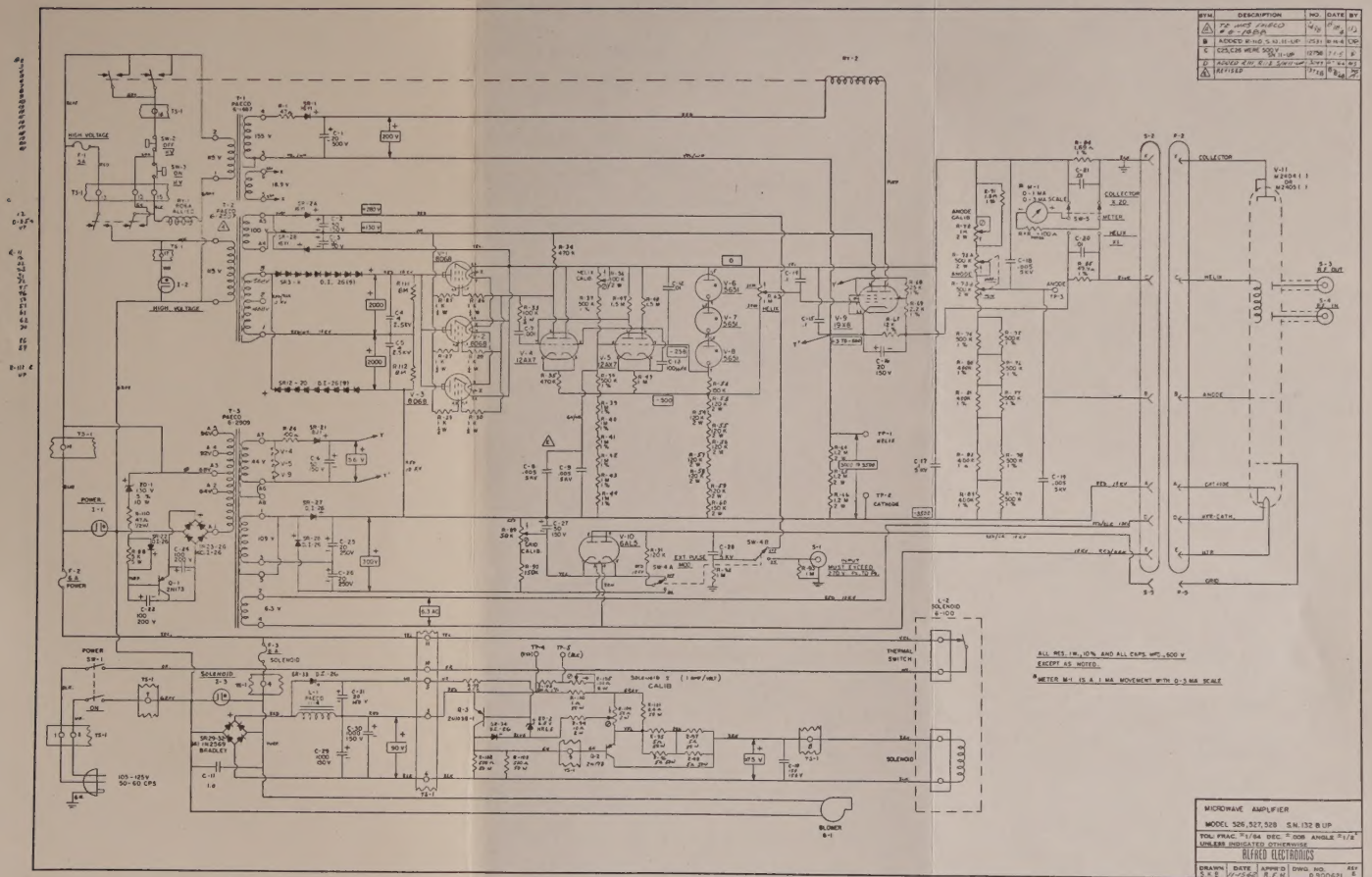
CIRCUIT REFERENCE	ALFRED PART NO.	DESCRIPTION	TOTAL QTY.	VENDOR	VENDOR PART NO.
SR1 and SR2	81-3	Rectifier, selinium, 130 v RMS, 0.025 A	2	General Inst.	16Y1
SR3 thru SR11	81-20	Diode, silicon, DI-26 or D1-46 Latest Substitute 1N4385	27	Diodes, Inc. Gen. Inst.	DI-26 or DI-46 1N4385
SR12 thru SR20		Same as SR3			
SR21	81-2	Rectifier, selinium, 130 v, RMS, 0.065A	1	Gen. Inst.	8J1
SR22		Same as SR3			
SR23 thru SR26		Same as SR3			
SR27 and SR28		Same as SR3			
SR29 thru SR32	81-18	Diode, Silicon, 1N2569 400 PIV, 6A, rectifier	4	Hughes	1N2569
SR33 and SR34		Same as SR3			
SW1	101-5	Switch, DPST, 16A @ 125 v	1	A.H & H	80600BJ
SW2	101-8	Switch, SPST, 10A @ 115 AC	1	Grayhill	2202
SW3	101-7	Switch, SPST, 10A @ 115 AC, red, N.O., momentary	1	Grayhill	2201
SW4	102-18	Switch, 2 pole, 2 position, 0.23A @ 115 VAC, non-shorting, steatite, 30° index	1	CRL	PA279-1597
SW5	101-4	Switch, DPDT, 6A @ 125 VAC	1	A.H. & H	81027CE

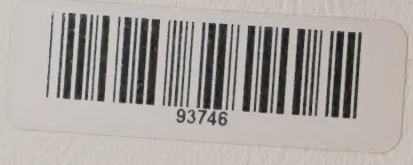
CIRCUIT REFERENCE	ALFRED PART NO.	DESCRIPTION	TOTAL QTY.	VENDOR	VENDOR PART NO.
T1	91-46	Transformer, power, 115 v primary 155 v at 15 ma, 18.9 v at 2.5 ma	1	Paeco	6-1487
T2	91-64	Transformer, power, 115 v primary 1568 v and 1468 v at 70 ma, 100 v at 20 ma	1	Paeco	6-2507
T3	91-72	Transformer, power, 115 v primary 109 v at 2 ma, 44.1 v at 0.175 A, 6.3 v at 0.7 A	1	Paeco	6-2909
TB1	941045A	Resistor-mounting board, 10 x 10	1		
TB2	941045A	Resistor-mounting board, 10 x 10	1		
TB3	941026A	Diode-mounting board, 6 x 6	1		
TB4	241024 A	Resistor-mounting board, 6 x 6	1		
TB5	941024A	Resistor-mounting board, 10 x 10	1		
TB6	941012A	Resister-mounting board, 16 x 16	1		
TB7	94211B	Phenolic sub-chassis	1		
TP1 thru TP4	133-28	Tip jack, 10A, 9KVDC, red, nylon	4	E.F. Johnson	105-802
TP5	133-29	Tip jack, 10A, 9KVDC, black, nylon	1	E.F. Johnson	105-803
TS-1	152-54	Terminal strip, barrier 17 terminal, 20 amp, lug for 16 to 14 ga	1	Cinch	17-141

CIRCUIT REFERENCE	ALFRED PART NO.	DESCRIPTION	TOTAL QTY.	VENDOR	VENDOR PART NO.
V1 thru V3	111-8068	Tube, electron 8068 beam pentode octal, E_p = 3500 v max.	3	Gen. Elect.	8068
V4 and V5	111-12AX7	Tube, electron 12AX7 twin triode, hi mu, 9 pin	2	RCA	12AX7
V6 thru V8	111-5651	Tube, electron, 5651, V.R. tube, 7 pin	3	RCA	5651
V9	111-19X8	Tube, electron, 19X8, triode-pentode converter, 9 pin	1	RCA	19X8
V10	111-6AL5	Tube, electron, 6AL5, twin diode, 7 pin PIV = 330	1	RCA	6AL5
V11	M2405F	TWT (Model 526 only) (Solenoid focussed)		Alfred Electronics	112-046
	M2404P	TWT (Model 527 only) (Solenoid focussed)		Alfred Electronics	112-044
	M2404Q	TWT (Model 528 only) (Solenoid focussed)		Alfred Electronics	112-045

CIRCUIT REFERENCE	ALFRED PART NO.	DESCRIPTION	TOTAL QTY.	VENDOR	VENDOR PART NO.
XF1 thru XF3	122-1	Fuse holder, type 3AG, twist-lock cap, panel mounting	3	Littelfuse	342004
XV1 thru XV3	136-7	Socket, tube, 8 pin octal, w/two mounting holes on 1-1/2" centers (mates w/133-12)	3	Cinch, Jones	8EB
XV4 and XV5	136-8	Socket, tube, 9 pin, shield base	3	Methode	SM-195-125-PB
XV6 thru XV8	136-5	Socket, tube, 7 pin, shield base	4	Methode	SM-187-125-PB
XV9		Same as XV4			
XV10		Same as XV6			
ZD-1	81-13	Diode, Zener, 1N3009B, 130 v, 5%, 10 w	1	Motorola	10M130Z5
ZD-2	81-38	Diode, Zener, 6.5 v, 0.2 w	1	Hoffman	HR 6.5

CIRCUIT REFERENCE	ALFRED PART NO.	DESCRIPTION	TOTAL QTY.	VENDOR	VENDOR PART NO.
	201-9	Blower, housing	1	Dayton	2C610
	201-8	Blower, motor	1	Dayton	2C610-4K850
	201-7	Blower, wheel (used with 201-8)	1	Dayton	2C610
	346-3	Clamp, cable, 1/4" plastic	1	Weckesser	#1/4-6R
	346-4	Clamp, cable, 5/16" plastic	2	Weckesser	#5/16-6R
	346-5	Clamp, cable, 3/8" plastic	1	Weckesser	#3/8"-6R
	346-15	Clamp, capacitor mounting, 5/8 to 11/16" diameter	25	Mallory	TH17
	346-15	Clamp, capacitor mounting, 7/8 to 15/16" diameter	3	Mallory	TH21
	346-21	Clamp, capacitor mounting, 1-7/8 to 2" diameter (used with 13-39)	2	Sangamo	#05
	133-35	Connector, 1 contact, 7.5 A, 10.6 KVDC, female mates with 133-34 or 133-42	1	Winchester	PM1S-LSH
	133-43	Connector, 1 contact, 7.5 A, 10.6 KVDC, female, mates with 133-34 or 133-42	1	Winchester	PM1S-LRN
	133-8	Conntector, 6 contacts, 7.5 A, 6.7 KVDC, female, mates with 133-25	1	Winchester	PM6S
	134-1	Connector, plate cap (tube) 3/8" ceramic	3	Millen	36002
	194-1	Coupling, for 1/4" shaft, insulated per 943002A	1	Meadows	Terminal
		Grommet, 1/2"			
	176-1	Handle, 6" mounting centers, 1-1/2" high, brass, nickel-plated	2	GOE	907
	153-1	Insulator, standoff, 3/4" long, 1/2" diameter 6-32 threaded, steatite	1	Millen	31011
	153-2	Insulator, standoff, 1" long, 3/8" diameter, 6-32 threaded, steatite	10	E.F. Johnson	135-500
	943030	Insulator, strip	12		
		Kep nut 8-32	4		
	171-9	Knob, round, 1-1/2" diameter, incl. skirt, black w/white index line	2	Raytheon	90-3-2
	171-8	Knob, round, 1-1/8" diameter, incl. skirt, black w/ white index line	1	Raytheon	70-3-2


REV. | DESCRIPTION | NO. | DATE | BY
A | TO MTS MICO # 6-1888 | 4/6 | 5/28/63 | RJ
B | ADDED R-110 5.11.1-UP | 12731 | 10-4-63 | CW
C | C25,C26 WERE 500 V | SN 11-UP 12758 | 11-5 | R
D | ADDED R-111 5.11.1-UP | 12773 | 11-26-63 | RJ
E | REVISED | 7716 | 8-28-67 | JP
MICROWAVE AMPLIFIER
MODEL 526,527,528 S.N. 132 & UP
TOL. FRAC. ±1/64 DEC. ±.005 ANGLE ±1/2° UNLESS INDICATED OTHERWISE
ALL RES. 1W, 10% AND ALL CAPS. WVC. 500 V EXCEPT AS NOTED.
*METER M-1 IS A 1 MA MOVEMENT WITH 0-3 MA SCALE
ALFRED ELECTRONICS
DRAWN S.K.S. 11-25-63 | DATE | APPR'D R.F.H. | DWG. NO. D 900621 | REV E
T-1 PACCO S-1687
T-2 PACCO S-1688
T-3 PACCO S-2909
HIGH VOLTAGE
POWER
SOLENOID
THERMAL SWITCH
BLOWER
COLLECTOR
ANODE
CATHODE
HELIX
GRID
RF OUT
RF IN
105-125V 50-60 CPS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